Theia: Handheld Braille Aid, Business Blueprint
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Executive Summary

Vision is one of the most essential human senses and plays a pivotal role in our lives. The global population of visually disabled is estimated at 285 million with 9 out of every 10 blind children in developing countries having no access to education. Our solution to this dreadful problem, Theia, is a portable electronic device that converts any handwritten and printed text on the fly into a dual audio and refreshable Braille feed on an innovative display.

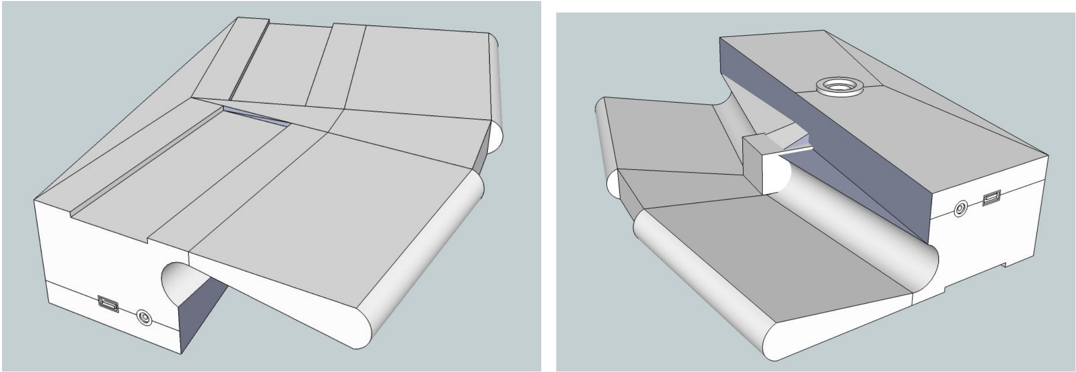
Theia is a handheld, lightweight, and low-energy piece of assistive technology that provides a real time reading experience for people with visual impairments. Theia works by converting any type of handwritten or printed text (e.g. books, receipts) using a simple onboard camera and image processing application into synthesized audio and refreshable Braille feed. To be more accessible, Theia would be available in two forms: a standalone electronic device, and an electronic smartphone case with complementing processing & imaging application. Thus Theia offers the competitive advantages of cost-effectiveness, enhanced accessibility and real-time social interaction.

The team consists of founder & CEO, *Saranyaraj Rajendran*, an electrical engineering graduate student with a rich leadership and innovative experience and is advised by *Charles Emley*, Managing Director of Arroyo Bridge Capital Partners & *Ellen Chiang*, Assistant Vice President at Meryl Lynch Wealth Management.

It's estimated to take 18 months to go through the first factory run and launch Theia. As the crux of the innovation lies with the electronically refreshable Braille display, we are working on three different forks of innovation for it to mitigate technological risk. Prior to launch we plan to actively cultivate partnership with organisations and institutions working with target market. As soon as we transition minimal working prototype to complete working prototype, we will work towards securing robust, reliable manufacturing partners. We will also consider an alternative approach in licensing technology to established players in the target market. These strategies would further help us mitigate market risks.

Introduction

The World Health Organization estimates a global population of 285 million with visual impairments[1]. Cost and accessibility are major barriers to universal education for learners with no or low vision. In developing nations, which have the largest blind population, lack of literacy materials impacts social mobility, poverty rates, and quality of life. Theia[2] (also known as the Greek goddess of vision and sight) is an assistive technology that provides a seamless e-reading experience for people with visual impairments. Lightweight, low-energy, and handheld, Theia breaks down the real-time barriers between the visually impaired and available printed texts (e.g. books, menus, receipts). Theia works by converting these printed and handwritten words on the fly into a dual audio and refreshable Braille feed on an innovative display, using a simple camera and optical character recognition software. Theia would be available in two forms[3] to cater the niche market: A. a standalone electronic device and B. as an electronic smartphone case with complementing applications.



Marketing and sales plan

Marketing plan

We envision two major phases for the marketing strategy, which are as follows:

- Phase I is B2B approach that targets institutions like schools, universities, NGOs, federal agencies, etc. Launching product at such grass root level would help us with initial cost, provide secure consumer base and also, a rich testing ground for further product iteration and development. There are two key strategies in this phase: A. forming and sustaining partnership with organisation directly involved with niche market such as Braille Institute in Los Angeles[4] or ICEVI (International Council for Education of

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[1] http://www.who.int/mediacentre/factsheets/fs282/en/

[2] Theia, concept video: http://goo.gl/TcJWxY

[3] Theia, conceptual design and 3D printed mockup: http://goo.gl/XwD8ch

[4] http://www.brailleinstitute.org/losangeles/

Children with Visual Impairment)[5]; B. securing a robust, reliable manufacturing partner for the device which most likely will be based in Shenzhen, China.

- Phase II is B2C approach to partner with or license the technology to device manufacturers. This would provide a better model to scale business and cater more consumers in the target market, availing their substantial manufacturing, sales and distribution channels. The key strategy in this phase is to leverage market penetration & technology robustness imbibed through Phase I to secure a successful partnership or licensing agreement.

Sustainable competitive advantage (Intellectual property)

- Crux of innovation for Theia lies with its innovative Braille Display. Electronically refreshable Braille display is a piece of low-cost, thin, low-power tech that generates Braille text on the fly. This gives it a considerable competitive edge both in terms of cost and accessibility compared to its competitors.
- The core concept of Theia of generating Braille and audio output for any printed or handwritten text on the fly is innovative and revolutionary in itself and is not available as a product on the market. This device integration would give us considerable advantage in the market over current competition such as Humanware[6] BrailleNote Apex 32 or Freedom Scientific [7] Focus 80 Blue. This advantage is further reinforced by the availability of the technology in two variants of A. a standalone electronic device and B. as an electronic smartphone case with complementing processing & imaging application, thus availing different socio-economic market segments.
- Partnership with institutions and organisations catering visually challenged niche as part of our B2B approach gives us the advantage of a viable market and sustainable revenue base.

The technology for the Theia's innovative Braille display has been the main focus of preliminary design and development. Following are the three forks of innovation pursued for Theia's Braille display technology, ensuring proof-of-concept and also mitigating technological risk.

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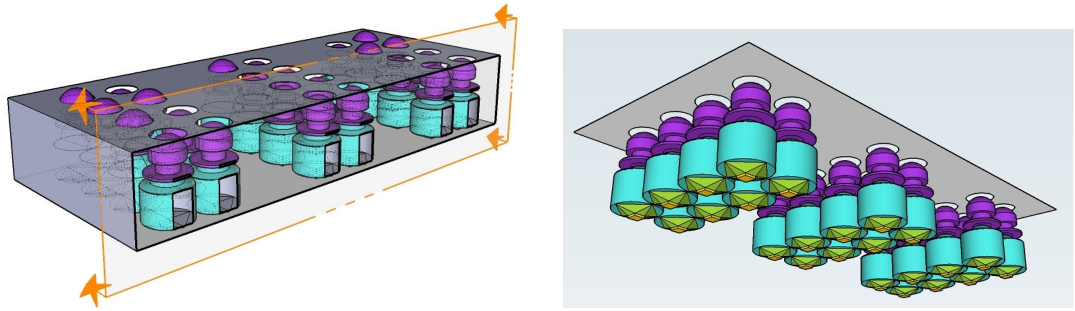
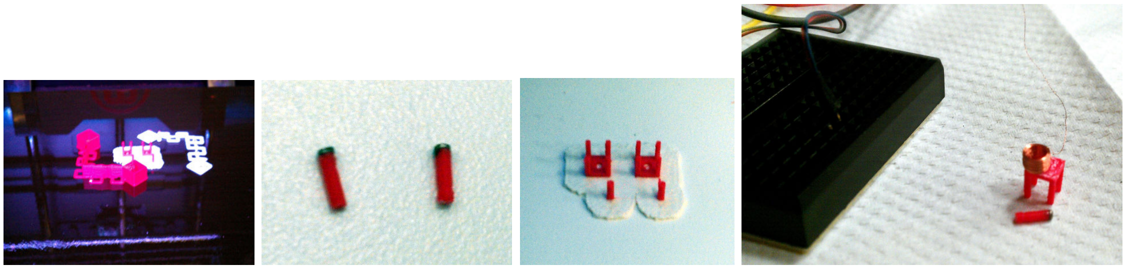
[5] http://www.cbm.org/International-Council-for-Education-of-Children-with-Visual-Impairment-ICEVI--377150.php

[6] http://www.humanware.com/en-usa/home

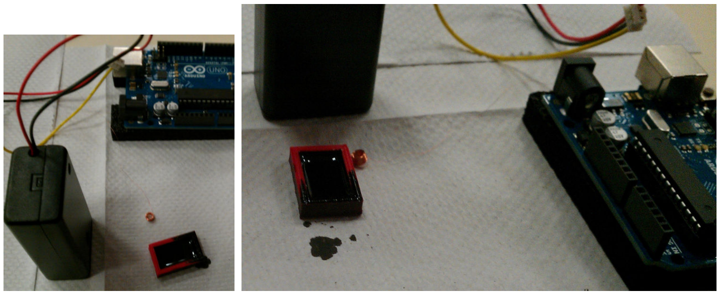
[7] http://www.freedomscientific.com/



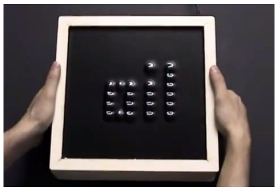
A. Braille Display using Electromagnetic Array[8]: First concept of using micro electromagnetic arrays for electronically refreshable Braille cells.



B. Braille Display using FerroFluid[9]: Second concept of using Ferromagnetic fluids with electromagnetic activation.



This concept was inspired by SnOil[10], a. interactive design project. Further iterations would involve refined and adapted versions of the concept with work focussing on reducing its scale and power requirements.



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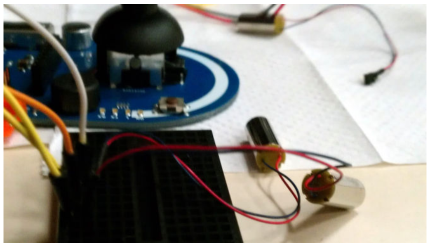
[8] Images: http://goo.gl/1fDXeY

[9] Images: http://goo.gl/Y9oM0V

[10] SnOil, Project Webpage: http://www.freymartin.de/en/projects/snoil

C. Braille Display using miniature, low-cost DC Motors[11]: Third concept of using miniature, low-cost DC motors to substitute costly, bulky Stepper motor present in most current Braille displays. Further work on this concept using gears and linear actuation mechanism for tactile Braille response would help bring Theia much closer to realization.



While further refinement and development is necessary for the device to reach the stages of complete functional prototype and initial manufacturing run, the innovation, the work, and the continuous progress leading to the current state of the prototype have proved its reliability and feasibility.

Launch

The initial stages of the product rollout would be based on B2B approach leveraging first phase of marketing strategy. The beginning phase of launch will focus on partners such as Braille Institute, LA. This type of partnership will pave way to connect and bring the product to other similar institutions and organisations. Along with ample access to customer base, this approach also ensures effective organic scaling and better customer rapport.

Sales forecasts

It's estimated to take 18 months to go through the first factory run and launch Theia. The hiatus in launch time is reflective of the time required to actualize complete functional prototype (CFP) as it transitions from minimal functional prototype (MFP) through iterative testing and development. Correspondingly, with key inputs from manufacturer, design for manufacture (DFM) stage would be realized paving way for finalizing operations, supply and logistics. We anticipate sales within the first month of product launch as a result of cultivated partnership with affiliated organisations and institutions.

Business model and processes

Business model

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[11] Images: http://goo.gl/U3nCvO

Theia would adopt B2B model with partner institutions and organisations, especially during initial product rollout. With a secure manufacturing source and robust logistics, we would engage in direct sales. This would constitute of either A. one time payment approach or B. another lucrative approach of subscription model based on device leasing which would help scale shiftly and provide a bound, sustainable market base. This would then gradually expand to B2C approach of next phase with addition of retailing and online sales channel.

We are also considering another profitable alternative of being a technology innovator and licensing the technology to a well established player in the target market such as HumanWare that would help leverage on the existing manufacturing, marketing, sales and distribution channels. Thus effectively forming a mutually beneficial partnership and enabling us to concentrate on further product innovation and development.

Business processes

- Product Design and Development
- Team and Talent recruitment
- Partnership and Industry relations
- Manufacturing and Logistics

Management and organizational plan

Management

Saranyaraj Rajendran is an electrical engineering graduate student at the USC Viterbi School of Engineering. He is the founder and CEO at Theia. Raj has rich innovative and leadership experience such as TEDx speaker, SVP, USC Viterbi Graduate Student Association and Senator, USC Graduate Student Government.

Advisors:
Charles Emley, Managing Director, Arroyo Bridge Capital Partners.
Ellen Chiang, Assistant Vice President, Financial Advisor, Meryl Lynch Wealth Management.

Team:
Team that will be recruited before launch

- Electrical Engineering
  - Embedded Systems Design engineer
  - Chip Design engineer
  - Image Processing and Computer Vision engineer
- Mechanical Engineering

    - Electromechanical Systems engineer
    - Industrial Design engineer
- Industrial Systems Engineering
    - Systems engineer
- Assistive Technology Specialist
- Curriculum Specialist

Financing plan

Financing

The project was awarded $15K prize money from USC Annenberg Innovation Lab as the Winner for CRUNCH Design Challenge '12[12]. The seed funding was used to source core electronics and hardware components for design and development. We are hoping to raise further funding at MEPC to sustain development of the finished prototype and transition to product launch. Initial soft launch through partner organisations and institutions would avail us grassroots access and sustainable base for further business scaling and iterative product development. The phase involving direct sales as a part of B2C channel, we would raise funding and generate sales by leveraging crowdsourcing (through services like Kickstarter) and pre-ordering. We are also considering smart alternative approaches such as joining Hardware Accelerators like HAXLR8R[13], Highway1.io[14] or Lemnos Labs[15], which would provide funding and a fine tuned development & commercialization ecosystem[16].

Summary

Vision is one of the most essential human senses and plays a pivotal role in our lives. The global population of visually disabled is estimated at 285 million with 9 out of every 10 blind children in developing countries having no access to education. Our solution to this dreadful problem, Theia, is a portable electronic device that converts any handwritten and printed text on the fly into a dual audio and refreshable Braille feed on an innovative display.

Theia would thus afford the visually challenged enhanced accessibility, independence and real-time social interaction.

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[12] http://goo.gl/IoINlN
[13] http://haxlr8r.com/
[14] http://highway1.io/
[15] http://lemnoslabs.com/
[16] HAXLR8R on Kickstarter, https://www.kickstarter.com/pages/haxlr8r